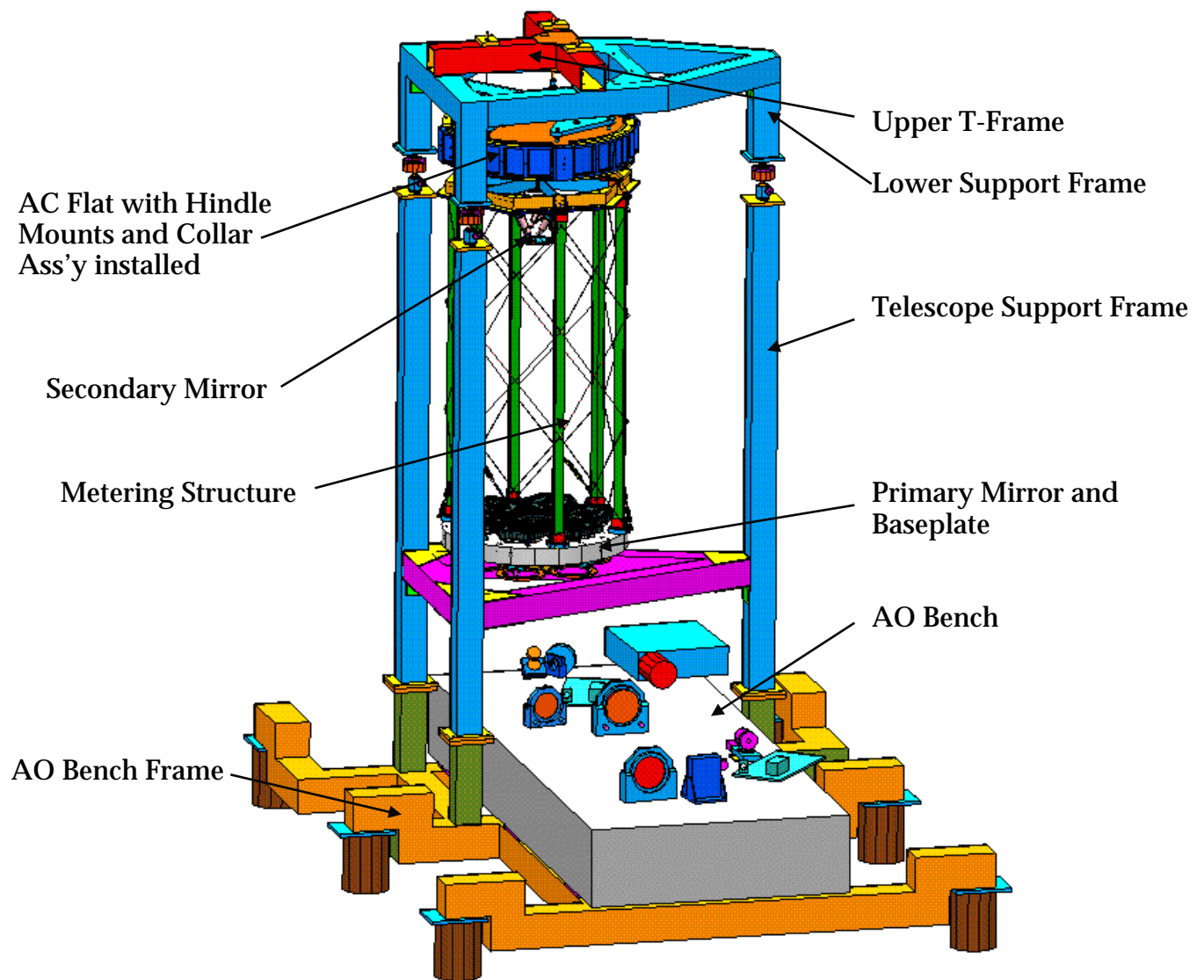


DCATT-MECH-PLAN-003**Tests to Characterize the Stability of the DCATT Assembly****Purpose:**

The purpose of this series of tests is to validate the adequacy of the DCATT structural components to allow the optical system to meet its functional objectives. The major concerns are how ambient vibrations are attenuated by the system, how acoustic energy and wind currents might affect the optics, and how thermal gradients might affect positioning of optics. A secondary objective is to gain experience handling the support frames, and positioning them to appropriate tolerances.

Test #1	Effect of Pneumatic Isolator Activation on Optical Alignment
Test #2	Vibration Isolation of AO Bench surface
Test #3	Modal Survey of Metering Structure
Test #4	DCATT Assembly Stability Test
Test #5	Effect of Thermal Gradients on Optical System



Test #1**Effect of Pneumatic Isolator Activation on Optical Alignment****Purpose:**

Prove that the isolators will not cause optical misalignments when activated. Will misalignment occur if optics are initially aligned while the AO Bench and AO Bench Frame are not floating on the isolators, then the isolators are activated?

Test Setup:

The AO Bench Frame Assembly and AO Bench are integrated with the Newport I-2000 pneumatic isolators. The isolators are “off” and the Bench frame is resting on the “bottomed out” isolators.

Procedure:

1. Ensure the AO Bench is oriented normal to the gravity vector with the isolators bottomed out and off.
Add additional jacks at appropriate places under the frame to level the AO Bench, if necessary.
Document locations.
2. Set up optical alignment instruments on the AO Bench as appropriate.
3. Activate the isolators.
4. Verify no optical misalignments occurred after activation

Test #2

Vibration Isolation on AO Bench surface

Purpose:

Determine the vibration environment experienced by optics on the AO Bench.

Setup:

AO Bench on the AO Bench Frame and normal to gravity vector

Isolators not activated.

Procedure:

1. Place accelerometers as appropriate on the top of the AO Bench and on the floor of the cleanroom.
2. Measure the vibration levels for a 24-hour period.
3. Activate the isolators
4. Measure the vibration levels for a 24-hour period.

Test #3

Modal Survey of Metering Structure

Purpose:

Determine the resonant frequencies of the metering structure and determine the motion of the secondary mirror baseplate due to vibrations. This will help to validate the FEM and provide verification that the vibrational displacement between primary and secondary mirrors will be within the requirements.

Setup:

Metering structure (with Kevlar straps) is assembled on the dummy baseplate

Dummy mass simulates secondary mirror assembly

Kevlar straps are initially tensioned to 20 lbf

Procedure:

1. Place metering structure on vibration table or tap test fixture
2. Instrument with accelerometers at appropriate locations
3. Begin sine sweep or tap with hammer at appropriate locations
4. Test differences resulting from unequally tensioned straps. Tighten straps 1-3 to full tension (60 lbf). Tighten straps 4-6 to low tension 5 lbf.
5. Begin sine sweep or tap with hammer at appropriate locations
6. Remove Kevlar straps
7. Begin sine sweep or tap with hammer at appropriate locations
8. Install aluminum bracing on metering structure
9. Begin sine sweep or tap with hammer at appropriate locations
10. Analyze results to determine frequencies
11. Analyze results to determine displacements of the secondary mirror baseplate.
12. Compare results with requirements.

Test #4

DCATT Assembly Stability Test

Purpose:

Determine the stability of the AC Flat and secondary mirror relative to the AO Bench top surface. This test will demonstrate that the ambient room vibration, acoustics, and airflow will not disturb the optical components beyond acceptable limits.

Setup

The following assemblies will be placed in the cleanroom

AO Bench Frame Assembly (2022800)

AO Bench

Telescope Support Frame (2022804)

AC Flat Support Frame Assembly with dummy AC Flat (2022811)

Telescope Metering Structure with dummy baseplate (2022799)

These assemblies will be oriented per the Top Level Assembly drawing 2022810 with one exception. The metering structure will be attached to the telescope support frame via simple aluminum spacer blocks that are clamped to the support frame members. The reason for this is that the interface ring has not yet been fabricated. The load paths, orientation, and mass will be simulated as close as possible and a sketch provided in the report.

The primary baseplate and mirrors are not available for this test. Dummy masses will be added to the dummy baseplate to simulate the real baseplate. The AC Flat will be simulated with an aluminum dummy mass.

Procedure:

1. Assemble the entire stackup of support frames on the DCATT AO Bench Frame with the isolation system off.
2. Instrument the dummy AC Flat bottom surface, AO Bench, dummy primary baseplate, and secondary mirror baseplate with accelerometers and optical alignment components
3. Activate the Hindle Mounts on the AC Flat
4. Do a baseline optical alignment check and record >15 minutes of accelerometer data.
5. Activate the isolation system.
6. Check the optical alignment of the system and take 24 hours of accelerometer data.
7. Check the optical alignment again.
8. Analyze results to determine relative displacements of AC Flat, secondary mirror, and primary mirror in the ambient room conditions.

Test #5**Effect of Thermal Gradients on Optical System****Purpose:**

Characterize the thermal environment in the cleanroom to determine how thermal gradients effect the optical system. Measure the ambient conditions and then create known thermal gradients on the AO Bench, metering structure, and support frames.

Setup

Same setup as Test #4 (entire DCATT Top Level Assembly with exceptions)

Procedures:

1. Place thermocouples or RTDs (resistance temperature detector) at appropriate locations on AO Bench, metering structure, and AC Flat Support Frame.
2. Place optical alignment devices on AO Bench, secondary mirror, and AC Flat
3. Measure the ambient temperatures on DCATT for 48 hours.
4. Compare the differences in temperature and the gradients and the shift in alignment of the optical devices.
5. Place heat sources on the AO Bench to simulate the source module and activate them
6. Observe and record the shift in alignment and the time necessary to reach steady-state conditions.
7. Turn off the heat sources.
8. Observe and record the shift in alignment and the time necessary to reach the new steady-state condition.